**California Re ional Water Quality ( ntrol Board**
**San Diego Region**

**Winston H. Hickox**
*Secretary for*
*vironmental*
*rotection*

Internet Address: http://www.swrcb.ca.gov/~rwqcb9/
9771 Clairemont Mesa Boulevard, Suite A, San Diego, California 92124-1324
Phone (619) 467-2952 • FAX (619) 571-6972

**Gray Davis**
*Governor*

December 8, 2000

FILE NO.: 06-0024.02

Mr. Richard Chase
Gregory Canyon Ltd.
P. O. Box 5846
Rancho Santa Fe, CA 92067

Dear Mr. Chase:

**RE: REVISED JOINT TECHNICAL DOCUMENT FOR GREGORY CANYON LANDFILL DATED DECEMBER 1999**

The purpose of this letter is to provide preliminary comments on the Joint Technical Document (JTD) received December 22, 1999 in application for waste discharge requirements for the proposed Gregory Canyon Landfill. On February 18, 2000, we transmitted a draft copy of these comments to you. At that time, the Regional Board indicated that the JTD was determined to be incomplete. Our comments on the JTD are shown below:

## Hydrogeology

### General Comments

The site is hydrogeologically complex with a variety of water-bearing materials including sedimentary, igneous, and metamorphic rocks. The ground water flow, except within the alluvium and highly weathered areas, is controlled primarily by fractures. Most of the analysis, modeling, and conclusions in the JTD are based on numerous simplifying assumptions, including the assumption that the fracture-controlled aquifer behaves as an equivalent porous medium. This is an acceptable approach to provide a generalized overview. However, given the hydrogeological complexity and size of the site, more detailed investigations are necessary to accurately understand the nature and behavior of ground water beneath the site. A better understanding of the site-specific hydrogeology is necessary to properly design the ground water monitoring program and proposed subdrain system.

### Specific Comments

1. There are an insufficient number of wells to fully characterize the site hydrogeology. In the area where the excavation is proposed to be below the "piezometric" surface, there is approximately 2000 feet laterally between wells. (Plate 5, GLA-5 to GMW-4 to GMP-2). In addition, these wells generally fall along the same line with only one other data point (GLA-4) not along the same line over a distance of approximately 4000 feet. This does

not allow for an accurate determination of the gradient, especially in the area proposed to be excavated over 150 feet below the ground water level.

2. Most of the wells, especially the deep ones, have too long of an open interval to determine the "piezometric" surface. The contours in Plate 5 and other interpretations are based on comparing wells constructed with screened or open intervals that vary from 12 feet screened in alluvium to nearly 300 feet in igneous rock. Given the complexity and size of the site, more detailed characterization is necessary to depict the ground water gradient in detail sufficient to allow for the design of a ground water monitoring program. For example, Plate 5 and the ground water elevations provided on pages 19 and 20 (Appendix N) indicate that the water elevation in GLA-8 is one to two feet higher than the water elevation in GMW-4, suggesting a southerly component to the ground water gradient in that area. GLA-8 and GMW-4 are in the vicinity of where the proposed bottom grade is approximately 100 feet below the water elevation. A more detailed investigation should be designed to identify localized variability in the gradient.

3. The outline of the area where the proposed bottom grade is below the piezometric surface is provided on Plate 5 in Appendix Q. Please provide a figure that shows the magnitude of the difference between the current ground water elevation and the proposed bottom grade.

4. It is our understanding that the hydrophysical logging performed by COLOG is a proprietary, specialized adaptation of the borehole dilution method for estimating the average velocity of ground water moving through the formation. This method may not be appropriate for this site. Please provide examples where this method has been used in fractured igneous rock aquifers, preferably where the conclusions have been confirmed by pumping tests.

5. The information from COLOG (letters, text, figures, graphs, and tables) is difficult to find in Appendix N. The table of contents for Appendix N indicates that Appendix C (of Appendix N) is the Report of BIPS and Hydrophysical Logging. It is not clear where Appendix C starts. Also the pages of the COLOG report(s) appear to out of sequence and possibly have some pages missing. Please consider organizing and clearly identifying the various reports and their associated figures, tables, and appendices within Appendix N.

6. In Appendix N, (approximately two-thirds back), the page entitled "Executive Summary of Hydrophysical Logging," by COLOG states that they used an experimental algorithm and that "...the application of this algorithm is considered experimental, the velocities and specific discharge values reported should be considered qualitative until independently confirmed by traditional methods." Similarly, Appendix C to the COLOG report(s) in Appendix N states that "...the coding is considered experimental and the

results generated should be considered as such until independently confirmed by traditional methods." What results should be considered experimental, and what calculations and conclusions in the JTD are dependent upon these qualitative values? What are the plans for independent confirmation by traditional means?

7. In Appendix N (approximately two-thirds back) a COLOG transmittal letter to Dr. Ferriz dated October 9, 1997 indicates that they provided "...an introductory page addressed to you regarding several issues you had brought to our attention." Please provide this information.

7 8. In Appendix N, page 35, third paragraph, the porosity of the deeper intervals are assumed to be 1 percent. Please provide additional data to support this assumption.

9. In Appendix N, page 21, between equation (3) and equation (4), the text states that "there is no information [for $\alpha$] available on fractured aquifers." To interpret the data, $\alpha$ is then set to 2.5. Please provide an explanation for choosing this value and an assessment of how the conclusions would be affected based on different values for $\alpha$.

10. Appendix N, pages 23 to 25. The hydrophysical logging may be a useful screening tool to identify more permeable zones in wells. However it is not appropriate to extrapolate the hydrophysical logging results to determine the appropriate spacing for monitoring wells. The hydrophysical logging (cross-hole test) suggests a hydraulic connection between various well pairs. The JTD document then extrapolates the demonstrated hydraulic connection to a "capture radius", which is then doubled to conclude the monitoring well spacing. This approach is unacceptable. The hydraulic connection was identified, in the case of GLA-7, by pumping at 11 gpm for 5 hours. Ground water monitoring wells are not typically pumped for extended time periods. A ground water monitoring program should be designed based on evaluating possible contaminant plume configuration and migration scenarios, with the well locations selected to intercept and detect a release without requiring that the monitoring wells be pumped to enhance their "capture radius." Conclusions regarding spacing and locations of monitoring wells should be based on the results of more detailed hydrogeological investigations.

11. Section C.2.3.1 and Appendices N and Q. The ground water flow model MODFLOW was used to simulate the Gregory Canyon ground water system. MODFLOW was developed for alluvial aquifers with sedimentary units having dip angles of less than 5 degrees. The use of this model is not appropriate for steeply-dipping fractured aquifers. The JTD indicates that MODFLOW was selected because of its availability, active use in ground water research, and a relatively large pool of experienced users. This is insufficient in that it does not provide technical justification for the use of an alluvial aquifer model in a fractured crystalline regime.

12. The vertical gradient has not been determined. The vertical gradient is likely different in the fracture-controlled aquifer located in the central and upper portion of the canyon than in the alluvial aquifer of the southern area. An understanding of the vertical gradient is essential to design a ground water monitoring program.

13. The one round of water level measurements performed in December 1996 does not provide sufficient data to assess the variations over time (seasonal and longer intervals).

14. Appendix N, GeoLogic letter dated October 10, 1999. The third paragraph on page 6 states that ground water flows from areas of high hydraulic head to areas of low hydraulic head. This is correct as long as there is a pathway. For ground water to flow, there needs to be both a hydraulic head differential and a pathway. In other words, the ground water flow in fractured igneous rock will necessarily follow fractures, which may not be aligned directly perpendicular to the equipotential lines. It is agreed that the flow will never oppose the potential gradient. However possible fracture-controlled ground water flow directions oblique to the hydraulic gradient need to be considered.

    As the letter correctly states on page 8, second paragraph, when the "fractures in the bedrock criss-cross and are closely spaced, which at a macroscopic scale allows ground water to flow through the fractured bedrock as if it were an equivalent porous medium." However excavation is proposed to remove over 150 feet of bedrock. It is the upper igneous material being removed that is pervasively fractured. Data and interpretations in the JTD indicate that there are considerably less "criss-cross" fractures in the underlying rock and the fractures are more widely spaced. Therefore ground water flow immediately beneath the liner will be highly dependent upon the fractures. Any releases from beneath the landfill will enter ground water within this less fractured rock, which will be less much less likely to exhibit hydrogeologic charactistics equivalent to a porous medium. The ground water monitoring program and the subdrain system cannot be properly designed without a detailed understanding of ground water flow in these rocks currently 100 to 150 feet below the current ground surface. Please indicate how the ground water flow within these rocks will be identified.

## <u>SUBDRAIN SYSTEM</u>

### General Comments

The proposed floor of the excavation is approximately 160 feet below the piezometric level. A subdrain system is proposed to prevent hydraulic pressure building beneath the liner. As indicated in the JTD, if the subdrain system fails to intercept all ground water, the liner may be compromised. In addition, is not likely that the subdrain system can be modified or repaired once the site is receiving wastes.

There is insufficient information to evaluate the adequacy of the subdrain system. The calculations regarding the seepage rates are based on assuming the fractured rocks will behave as an equivalent porous flow medium. However as discussed in the ground water specific comments above, the ground water flow beneath the proposed excavation will be more fracture dependent. Therefore it is more likely that ground water infiltration into the excavation will be concentrated in yet unidentified areas.

**Specific Comments**

1. How does the design of the subdrain system address the likelihood that ground water inflow will be concentrated in certain areas?

2. Figure 14 and Appendix Q. Based on review of detail 3/17 in Figure 14, any ground water in the material between the geocomposite and the HDPE geomembrane or in the formation adjacent to the geocomposite layer will be less than 5 feet from the wastes, particularly if greater than expected localized ground water inflow occurs, for example along a fracture. Please clarify how the subdrain system will maintain the 5-foot separation along the side slopes of the landfill between the benches.

3. Fluctuations in ground water elevations, particularly in fractured regimes and areas with considerable topography, may exceed 20 feet or more over the period of a few years. How will the subdrain system be affected during years with above average rainfall?

4. The expected inflow to the subdrain system was estimated using modeling with limited site-specific data. It is recommended that an extended pumping test be conducted in the vicinity of the deepest proposed dewatering area to determine the actual flow rates necessary to dewater large areas over 150 feet below the static water level.

5. Given that virtually all of the area of Gregory Canyon adjacent to the proposed foot print is fractured igneous and metamorphic rock, it is likely that a considerable amount of rain and runoff will flow into the subsurface and enter the subdrain system as opposed to the surface water control system. How much of the water during rain events will enter surface fractures and reach the subdrain system? How has the subdrain system design accounted for this possibility?

6. No details are provided regarding the maintenance of the subdrain system.

7. How will the ongoing effectiveness of the subdrain system be evaluated?

8. How will repairs be made to the subdrain system in the event of decreased performance?

9. Since the proposed subdrain system is designed to lower the water table by over 150 feet in the middle of Gregory Canyon, it may effectively de-water a portion or all of the surrounding areas. Please indicate what effect this may have on adjacent properties to the south, such as the existing agricultural activities. How far outside the property boundaries will the cone of depression associated with this dewatering extend?

10. The modeling yielded seepage rates of 0.0047 to 0.009 gpd/ft$^2$ The JTD (Section C.2.3.1, last paragraph) then reduces this by a factor of 10 prior to calculating a total volume. However Appendix Q, page 5, third paragraph states that the worse case flux was used to design the subdrain system, implying that the factor of 10 was not used. Please clarify what flux rate was used and provide justification for reducing the seepage rate by a factor of 10. In addition, please check the arithmetic and units in this paragraph (Section C.2.3.1, last paragraph). It appears that the units were changed from gpd/ft$^2$ to ft$^3$/ ft$^2$ when the factor of 10 is applied.

11. Using the seepage rate of 0.009 gpd/ft$^2$ times the area of the excavation that is below the piezometric level (2,640,000 ft$^2$) results in 23,760 gallons per day. The proposed storage tank has a capacity of 10,000 gallons, suggesting that the tank may require emptying two to three times per day. Please provide details regarding how this volume of water will be collected, stored, sampled, and disposed of.

## CEQA

We understand that a Revised Draft Environmental Impact Report (EIR) has been prepared for this project. You will need to submit one copy of the final EIR, the Notice of Determination and a copy of a summary of the EIR prior to adoption of waste discharge requirements by the Regional Board.

## Conclusion

We understand that a new Joint Technical Document will be submitted to this office on December 22, 2000. Upon receipt of the new JTD, we will have 30 days to determine whether or not the JTD is complete. We may provide additional review comments at that time.

If you have any questions, please contact Ms. Carol Tamaki at (858) 467 - 2982.

Sincerely,

JOHN R. ODERMATT
Senior Engineering Geologist
Land Discharge Unit

JRO:cat:clc

cc: Michele Stress, Department of Environmental Health, County of San Diego
John Boucher, Brian A. Stirrat & Associates
Jerry Riessen, Gregory Canyon Ltd.